https://dx.doi.org/10.4314/WOJAST.v14i2.82

ISSN: 2141 – 3290
www.wojast.org

Supported by tetfund
TERTIARY EDUCATION TRUST FUND

THE BREEDING OF HOUSE FLY; *Musca domestica* L., USING DIFFERENT SUBSTRATES IN UYO METROPOLIS, AKWA IBOM STATE, NIGERIA.

ESENOWO, I. K[1]., AKPAN, A. U[1]., UBULOM, P. M. E[1]., CHUKWU, M. U[2]., ADEYEMI-ALE O. A[3]

[1]Department of Animal and Environmental Biology, University of Uyo, Nigeria.
[2]Department of Pure and Applied Sciences, National Open University of Nigeria.
[3]Department of Zoology, University of Ilorin, Nigeria
*Corresponding author's email: imehesenowo@yahoo.com

ABSTRACT

The study on the breeding of housefly; *Musca domestica*, using different substrates in a closed environment was carried out in Uyo, Akwa Ibom State, Nigeria. Four substrates; bread, milk, decomposed cow bones, and poultry manure were obtained from different locations within Uyo metropolis. More care was given to collecting of cow bones and poultry manure to ensure that they were free of maggots. The dry substrates were sprinkled with 0.5 L of sterile distilled water. A measure of 50 g of each of the substrates were made using digital measuring scales and placed in the breeding media. Each substrate was placed inside the transparent glass box; breeding media. Fly attractant; 0.1 kg was added to each of the substrate inside the box. The four boxes with the substrates treated with fly attractant were exposed for 5 hours for natural egg deposition by houseflies. The temperature and humidity of each of the breeding media and treated substrate were taken and recorded. The results revealed that bread plus milk substrate producing more larvae (1 - 10 days) (90.00±5.51) and more adults (22 – 35 days) (84.33±2.85), followed by wet cow bones (45.67±17.95), and wet bread only (21.67±14.81). Bread plus milk substrate produced total occurrence of the larvae and adults of 74.33±9.72, while wet bread substrate alone produced 29.22±8.22. The occurrence of larvae (1- 10 days) and adults (22-35 days) across the substrates was significantly different at p value of 0.007 and 0.000 respectively. The results obtained indicate that bread plus milk substrate present a better condition for the development of the immature and adults' states of the housefly as compared to other substrates. Therefore, all decomposing organic materials should be properly disposed to avoid the outburst of houseflies' population in the environment and its nuisance to human and animals.

Keywords: Substrates, *Musca domestica*, distilled water, temperature and moisture.

Introduction

House fly, *Musca domestica* L. (Diptera: Muscidae), is an important commensal and metropolitan dipteran, capable of surviving in a broad spectrum of environments. It lives in close proximity to humans and animals, and other open places such as food markets, farms, and ranches, hovering around decaying matter, garbage, faeces, and human food (Mullens *et al*., 2002; Paterson, 2009; Sanchez-Arroyo and Capinera, 2017.). Houseflies prefer warmer environment (optimal 30°C) and drier conditions but are able to breed at a reduced rate throughout colder seasons, typically in livestock stables. The species is found on every continent, except for Antarctica (Farkas *et al*., 1998).

The house fly represents an insect of great economic importance, best of its ecological role it plays a significant role in contaminating animal products and transmitting a variety of pathogens to humans and animals, as well as causing problems by invading residential areas and affecting the quality of life of these populations. This insect is able to develop on various substrates of which their chemical and biological characteristics differed (Farkas *et al.*, 1998). The substrates include human excrement, horse, bovine, swine, bird, sheep and goat dung, decomposing vegetal material, kitchen waste, cut grass, and carrion, etc. (Cook *et al.*, 1999), of which the rate and quality of breeding of houseflies on these different substrates could differ given that the rate and quality of the production and development of the houseflies depends on the chemical and biological characteristics of each substrate (Mullens *et al*., 2002). The generation of this study is important to contributing to the optimal control and management of houseflies in the environment, reducing the costs associated with flies control and improving the quality of lives in the ecosystem and livestock units. Nevertheless, there is dearth of information on housefly breeding using different substrates in this part of the country.

Materials and methods

Study site:

The study was carried out in Entomology Breeding Laboratory of the Animal house in the Department of Animal and Environmental Biology, University of Uyo, Uyo. Akwa Ibom State. The Animal house lies within Latitude N5º2'26.004" and Longitude E7º58'45.054".

https://dx.doi.org/10.4314/WOJAST.v14i2.82

Substrate collection

The substrates used were obtained from different locations in the city of Uyo metropolis in Akwa Ibom State. Four different substrates were collected and they were bread, milk, decomposed cow bones, and poultry manure. The poultry manure was collected from a daily farm and the cow bones from an abattoir in Uyo. Standard procedures were implored in collecting cow bones and poultry manure to ensure that they were free of maggots. Besides, the two substrates, to further prevent the presence of maggots at the time of collection were kept in a drying oven under temperature of 50ºC for 5 min in the Laboratory of the Department of Animal and Environmental biology, University of Uyo. Once the manure reached room temperature, the lost moisture was restored through the addition of 0.5 L of distilled water according to Larraín and Salas (2007) and the dried maggots (larvae) were removed by handpicking.

Substrate Treatments

Exactly 50 g of each of the substrates were measured using digital measuring measure. Four transparent glass boxes of size 25 cm x 25 cm with an opening on top were used as the breeding media. Each substrate was placed inside the transparent glass box. The substrate inside the breeding medium box was sprinkled with distilled water (0.5 L) and treated with clean fish viscera (Fly attractant) (0.1 kg). The four glass boxes with the substrates and fly attractant were exposed for 5 hours for natural egg deposition by houseflies. After exposure, all the boxes were covered with netting materials. The glass boxes were kept indoors, with windows and door open. During the period, water was sprinkled on the substrate on daily basis to keep it moist according to Nkongho *et al*. (2020). The temperature and humidity of each of the glass and treated substrate were taken using dual digital thermometer each day and recorded. The glass boxes were monitored twice daily; 7am – 10am in the morning and 5pm to 6pm in the evening (Nkongho *et al*., 2020) for emergence of larvae, pupae and adults, and once emergence began, counting began, recorded, and the counted larvae (maggots) were returned into the glass, while the adults were removed from the substrate and disposed properly.

Statistical Analysis

Data obtained were entered into Microsoft Excel version 2013, and mean, standard error, and correlation analyses were performed using PAST version 4.0.

Results

The results on the occurrence of larvae and adults obtained on different days revealed that bread plus milk substrate produced more larvae from (1 to 10 days) 90.00±5.51, followed by wet cow bones 45.67±17.95, and wet bread alone (21.67±14.81) (Table 1). The results on the occurrence of the adults is also presented on table 1. Bread plus milk substrate produced the total of occurrence of the larvae and adults (74.33±9.72) (Table 1). The results on the total occurrence of the larvae and adults are also presented on table 1. The occurrence of larvae from (1-10 days) and adults from (22-35days) across the substrates was significantly different at p value of 0.007 and 0.000 respectively.

The results on the temperature and humidity profile of the substrates on the larvae and adults occurrence are presented on Tables 2 and 3.

Table 1: Occurrence of Larvae and Adults of *Musca domestica* (Housefly) with different Substrates

Substrates	Occurrence			Total Of Occurrence
	Larvae (1 - 10 days)	Adults (14 - 21 days)	Adults (22 - 35 days)	
Wet Bread Alone	21.67±14.81^{b}	15.00±15.00^{a}	51.00±0.58^{b}	29.22±8.22^{b}
Wet Cow Bones	45.67±17.95^{b}	0.00±0.00^{a}	40.33±1.20^{c}	28.67±8.88^{b}
Bread + Milk	90.00±5.51^{a}	48.67±24.36^{a}	84.33±2.85^{a}	74.33±9.72^{a}
Wet Poultry Drops	7.00±7.00^{b}	0.00±0.00^{a}	11.33±5.70^{d}	6.11±3.08^{b}
Total	41.08±10.87	15.92±8.55	46.75±7.99	34.58±5.64
p Value	0.007*	0.127ns	0.000*	0.000*

Means along the same column with different alphabet(s) are significantly different at p<0.05.

https://dx.doi.org/10.4314/WOJAST.v14i2.82

Table 2: Temperature Profile of Substrates on Adults and Larvae

Substrate	Temperature			Total
	Larvae (1 - 10 days)	Adults (14 - 21 days)	Adults (22 - 35 days)	
Wet Bread Alone	27.70±0.12[a]	27.00±0.56[a]	27.00±0.36[a]	27.23±0.23[a]
Wet Cow Bones	27.67±0.07[a]	27.00±0.51[a]	26.73±0.32[a]	27.13±0.22[a]
Bread + Milk	27.53±0.07[a]	27.63±0.17[a]	27.83±0.12[a]	27.67±0.08[a]
Wet Poultry Drops	27.60±0.10[a]	27.83±0.03[a]	27.57±0.12[a]	27.67±0.06[a]
Total	27.63±0.04	27.37±0.20	27.28±0.17	27.43±0.09
p Value	0.590ns	0.359ns	0.054ns	0.052ns

Means along the same column with the same alphabet(s) are not significantly different at $p<0.05$.

Table 3: Humidity profile of substrates on the emergence of Adults and Larvae

Substrate	Humidity (%)			Total
	Larvae (1 - 10 days)	Adults (14 - 21 days)	Adults (22 - 35 days)	
Wet Bread Alone	84.33±0.33[a]	87.67±0.33[a]	92.00±2.52[a]	88.00±1.33[a]
Wet Cow Bones	83.33±0.33[a]	88.67±0.33[a]	91.00±2.52[a]	87.67±1.35[a]
Bread + Milk	86.33±1.20[a]	86.33±0.33[a]	93.67±2.67[a]	88.78±1.49[a]
Wet Poultry Drops	86.00±1.15[a]	89.67±3.18[a]	87.33±0.88[a]	87.67±1.14[a]
Total	85.00±0.52	88.08±0.78	91.00±1.19	88.03±0.64
p Value	0.119ns	0.539ns	0.312ns	0.926ns

Means along the same column with the same alphabet(s) are not significantly different at $p<0.05$.

The correlation results of the mean abundance of the occurrence of the larvae and adults of the housefly revealed that temperature was negatively correlated to larvae (1-10 days) ($r = -0.61$, $p<0.05$) and humidity expressed strong negative correlation relationship to adults ($r = 0.93$ $p < 0.05$) (Table 4).

Table 4: Correlation of mean abundance of *Musca domestica* larvae and adults against temperature and humidity

	Larvae (1 - 10 days)	*Temperature*	*Humidity*
Larvae (1 - 10 days)	1		
Temperature	-0.61*	1	
Humidity	0.24	-0.86*	1
	Adults (14 - 21 days)	*Temperature*	*Humidity*
Adults (14 - 21 days)	1		
Temperature	0.25	1	
Humidity	-0.93*	0.11	1
	Adults (21 - 35 days)	*Temperature*	*Humidity*
Adults (22 – 35 days)	1		
Temperature	0.25	1	
Humidity	-0.93*	0.11	1

* - Strong negative or positive correlation.

Discussion

The results indicated that wet cow bones and wet poultry drops did not produced adults from 14 – 21 days, but produced from 22 – 35 days, while wet bread alone and bread plus milk substrates supported the production from 14 – 21 and 22 – 35 days. Bread plus milk substrate supported high number of adult house flies production from 14 – 21 days and 22 – 35 days. The variation in the breeding rate of the adult house flies from the different substrates, according to Wortman *et al*. (2006) is that reduced moisture or near dry nature of the substrates for example in the incase of wet cow bones and wet poultry drops, could cause larvae mortality and pupae inhibition.

In effect, Moon *et al*. (2001) established that when the moisture levels of decomposing organic material is reduced to levels below 40%, which from the results does not hold because the moisture content was higher than 40%, mortality of the larvae and pupae inhibition will set-in. The moisture levels results for adults from (22 – 35 days) as obtained in this study was at optimum moisture levels for development of the adult house flies across the substrates.

The correlation results show that temperature has relationship with the larvae stage development across the substrates. The results indicate that the temperature was inversely proportional to the development of the larvae and this could be deduced that as temperature increases larvae development to pupae decreases (Moon *et al*., 2001). The results also indicate that moisture content of the substrates have a relationship to the duration of the larval and adults' states of the development of the house flies (Mullens *et al*., 2002).

Another observation in this study was the presence of other flies around the substrates in the glass media, and these flies were carefully harvested and discarded. This implies that other flies may have laid eggs on the substrates at the time of infestation. Similar observation was reported by Larrain and Salas (2008). Nevertheless, from the study it could be suggested that all decomposing organic materials be disposed properly to avoid the outburst of houseflies' population in the environment and its nuisance to human and animals.

Conclusion

The results obtained indicate that bread plus milk substrate present better conditions for the development of the immature and adults' states of the house fly. Substrates compost based on cow bones and dry poultry does not allow for proper development of house flies, owing to the low humidity for the insect, as a result of the composting process.

Reference

Cook, D., Dadour, I. and Keals, N. (1999). Stable fly, house fly (Diptera: Muscidae), and other nuisance fly development in poultry litter associated with horticultural crop production. *Journal of Economic Entomology* 92:1352-1357.

Farkas, R., Hogsette, J. and Börzönyi. L. (1998). Development of *Hydrotaea aenescens* and *Musca domestica* (Diptera: Muscidae) in poultry and pig manure of different moisture content. *Environmental Entomology.* 27:695-699.

Larraín, P. S. and Salas, C. F. (2008). House fly (*Musca domestica* L.) (DIPTERA: Muscidae) development in different types of manure. *Chilean Journal of Agricultural Research*. 68:192-197

Moon, R., Hinton, J., O'Rourke, S. and Schmidt, D. (2001). Nutritional value of fresh and composted poultry manure for house fly (Diptera: Muscidae) larvae. *Journal of Economic Entomology* 94:1308-1317.

Mullens, B., Szij, C. and Hinkle, N. (2002). Oviposition and development of *Fannia* spp. (Diptera: Muscidae) on poultry manure low moisture levels. *Environmental Entomology* 31:588-593.

Nkongho, G. O., Severe, B. B., Herve, Aziwo, T. N., Tabikam, A. I., David, M., Carole, N., Etchu, S. and Agbor, K. (2020). Influence of Culture Medium on Productivity and Nutrient Composition of the Housefly (*Musca domestica*) Maggot. *International Journal of Research Studies in Biosciences*. 8(16): 5-9. *DOI: https:// doi.org/10.20431/2349-0365.0806003*

Paterson, H. E (2009). The *Musca domestica* complex in Sri Lanka. *Journal of Entomology Series B, Taxonomy*. 43 (2): 247–259.

Sanchez-Arroyo, H. and Capinera, J. L. (2017). "House fly: *Musca domestica* ". Featured Creatures. Retrieved 20 March 2020.

Wortman, Ch., Shapiro, Ch. and Tarkalson, D. (2006). Composting manure and other organic residues. University of Nebraska-Lincoln Extension, Institute of Agriculture and Natural Resources, Lincoln, Nebraska, USA. Available at http://www.ianpubs.unl.edu/epublic/pages/index.jsp?what= publication D&publicationId=567 (Accessed 5 December 2007).